



## TFT LCD Approval Specification

# MODEL NO.: V201V4 - T01

Customer: \_\_\_\_\_

Approved by: \_\_\_\_\_

Note:

LCD TV Head Division	
AVP	郭振隆

QRA Dept.	TVHD / PDD		
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OPTOELECTRONICS CORP.

Issued Date: Mar. 31, 2005

Model No.: V201V4-T01

**Approval****REVISION HISTORY**

Version	Date	Page (New)	Section	Description
Ver 2.1	Mar. 31, 2005	All	All	Approval Specification was first issued.

## 1. GENERAL DESCRIPTION

### 1.1 OVERVIEW

V201V4-T01 is a 20.1" TFT Liquid Crystal Display module with 4U type-CCFL Backlight unit and 1ch-TTL interface. This module supports 640 x 480 VGA format and can display true 16.2M colors (6-bit+FRC/color).

### 1.2 FEATURES

- High brightness ( 450 nits)
- High contrast ratio (400:1)
- Fast response time
- High color saturation NTSC 75%
- VGA ( 640 x 480 pixels) resolution
- TTL Interface

### 1.3 APPLICATION

- TFT LCD TVs

### 1.4 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Active Area	408 (H) x 306 (V)	mm	(1)
Bezel Opening Area	412 (H) x 310 (V)	mm	
Driver Element	a-si TFT active matrix	-	-
Pixel Number	640 x R.G.B. x 480	pixel	-
Pixel Pitch(Sub Pixel)	0.2125 (H) x 0.6375 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	16.2M	color	-
Display Operation Mode	Transmissive mode / Normally white	-	-
Surface Treatment	Anti-reflective coating + Anti-glare coating	-	-

### 1.5 MECHANICAL SPECIFICATIONS

Item	Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	465.0	466.0	mm	Module Size
	Vertical(V)	329.0	329.3	mm	
	Depth(D)	34.48	35.48	mm	From front frame to rear plate
Weight	2360	2460	2560	g	-

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

## 2. ABSOLUTE MAXIMUM RATINGS

### 2.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T <sub>ST</sub>	-20	+60	°C	(1)
Operating Ambient Temperature	T <sub>OP</sub>	0	50	°C	(1), (2)
Shock (Non-Operating)	S <sub>NOP</sub>	-	50	G	(3), (5)
Vibration (Non-Operating)	V <sub>NOP</sub>	-	1.0	G	(4), (5)

Note (1) Temperature and relative humidity range is shown in the figure below.

(a) 90 %RH Max. ( $T_a \leq 40\text{ }^{\circ}\text{C}$ ).

(b) Wet-bulb temperature should be 39 °C Max. ( $T_a > 40\text{ }^{\circ}\text{C}$ ).

(c) No condensation.

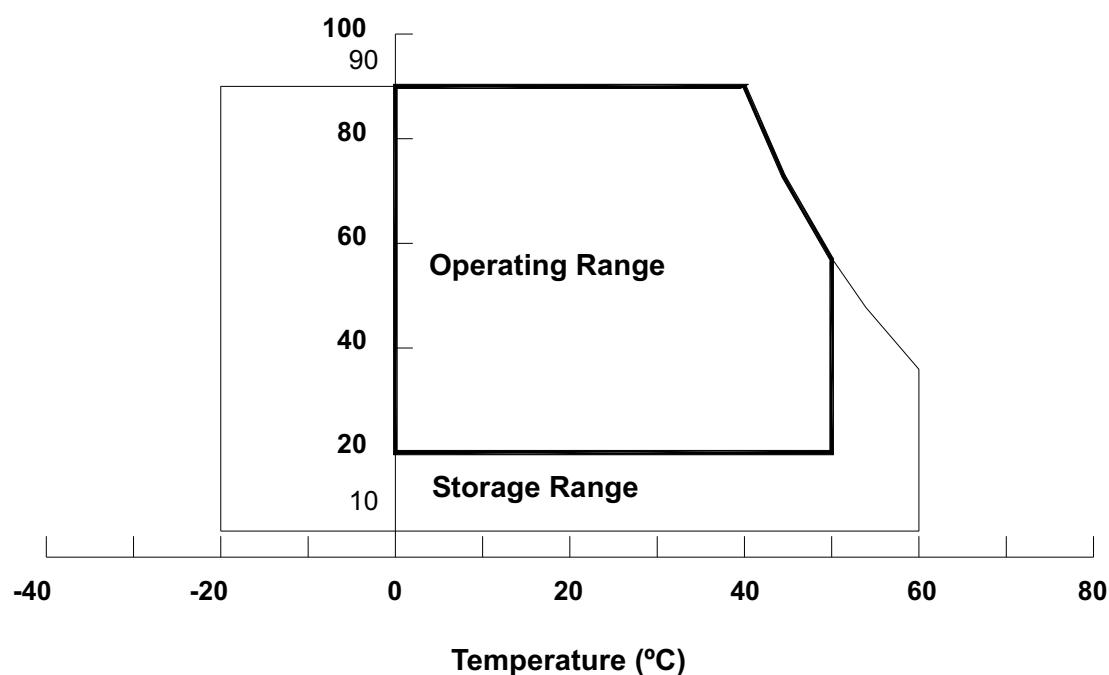
Note (2) The maximum operating temperature is based on the test condition that the surface temperature of display area is less than or equal to 60 °C with LCD module alone in a temperature controlled chamber. Thermal management should be considered in your product design to prevent the surface temperature of display area from being over 60 °C. The range of operating temperature may degrade in case of improper thermal management in your product design.

Note (3) 11 ms, half sine wave, 1 time for  $\pm X$ ,  $\pm Y$ ,  $\pm Z$ .

Note (4) 10 ~ 500 Hz, 10 min, 1 time each X, Y, Z.

Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

**Relative Humidity (%RH)**





## 2.2 ELECTRICAL ABSOLUTE RATINGS

### 2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	V <sub>cc</sub>	-0.3	6.0	V	

### 2.2.2 BACKLIGHT UNIT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Lamp Voltage	V <sub>w</sub>	—	3000	V <sub>RMS</sub>	

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Functional operation should be restricted to the conditions described under normal operating conditions.

### 3. ELECTRICAL CHARACTERISTICS

#### 3.1 TFT LCD MODULE

Ta = 25 ± 2 °C

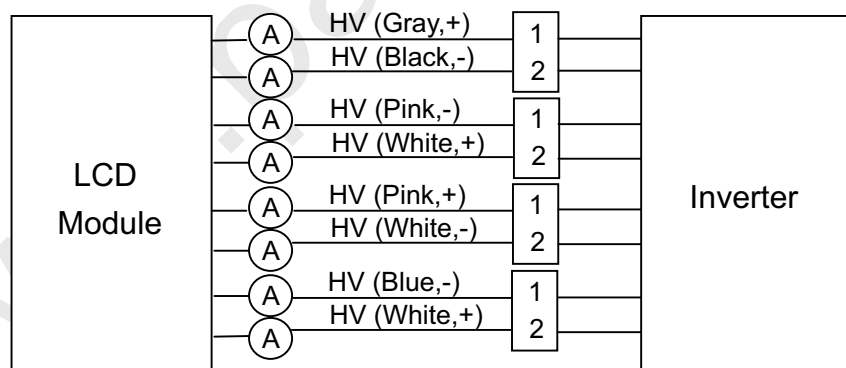
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		VGH	23.5	24	24.5	V	
		VGL	-6.0	-5.6	-5.0	V	
		VAA	9.7	10	10.3	V	
		V33V(3.3V)	3.0	3.3	3.6	V	
		VREF	9.25	9.3	9.34	V	
Power Supply Current		IGH	-	3	-	mA	
		IGL	-	3	-	mA	
		IAA	-	150	-	mA	
		I3.3V	-	70	-	mA	
CMOS interface	Input High Threshold Voltage	V <sub>IH</sub>	2.7	-	3.3	V	
	Input Low Threshold Voltage	V <sub>IL</sub>	0	-	0.7	V	

#### 3.2 BACKLIGHT UNIT

##### 3.2.1 CCFL (Cold Cathode Fluorescent Lamp) CHARACTERISTICS (Ta = 25 ± 2 °C)

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Lamp Voltage	V <sub>W</sub>	-	1490	-	V <sub>RMS</sub>	I <sub>L</sub> = 5.5mA
Lamp Current	I <sub>L</sub>	5.0	5.5	6.0	mA <sub>RMS</sub>	(1)
Lamp Starting Voltage	V <sub>S</sub>	-	-	2250	V <sub>RMS</sub>	(2), Ta = 0 °C
		-	-	2110	V <sub>RMS</sub>	(2), Ta = 25 °C
Operating Frequency	F <sub>O</sub>	50	-	70	KHz	(3)
Lamp Life Time	L <sub>BL</sub>	50,000	60,000	-	Hrs	(4)

Note (1) Lamp current is measured by utilizing high frequency current meters as shown below:



Note (2) The lamp starting voltage V<sub>S</sub> should be applied to the lamp for more than 1 second under starting up duration. Otherwise the lamp may not be turned on.

Note (3) The lamp frequency may produce interference with horizontal synchronous frequency from the display, and this may cause line flow on the display. In order to avoid interference, the lamp frequency should be detached from the horizontal synchronous frequency and its harmonics as far as possible.

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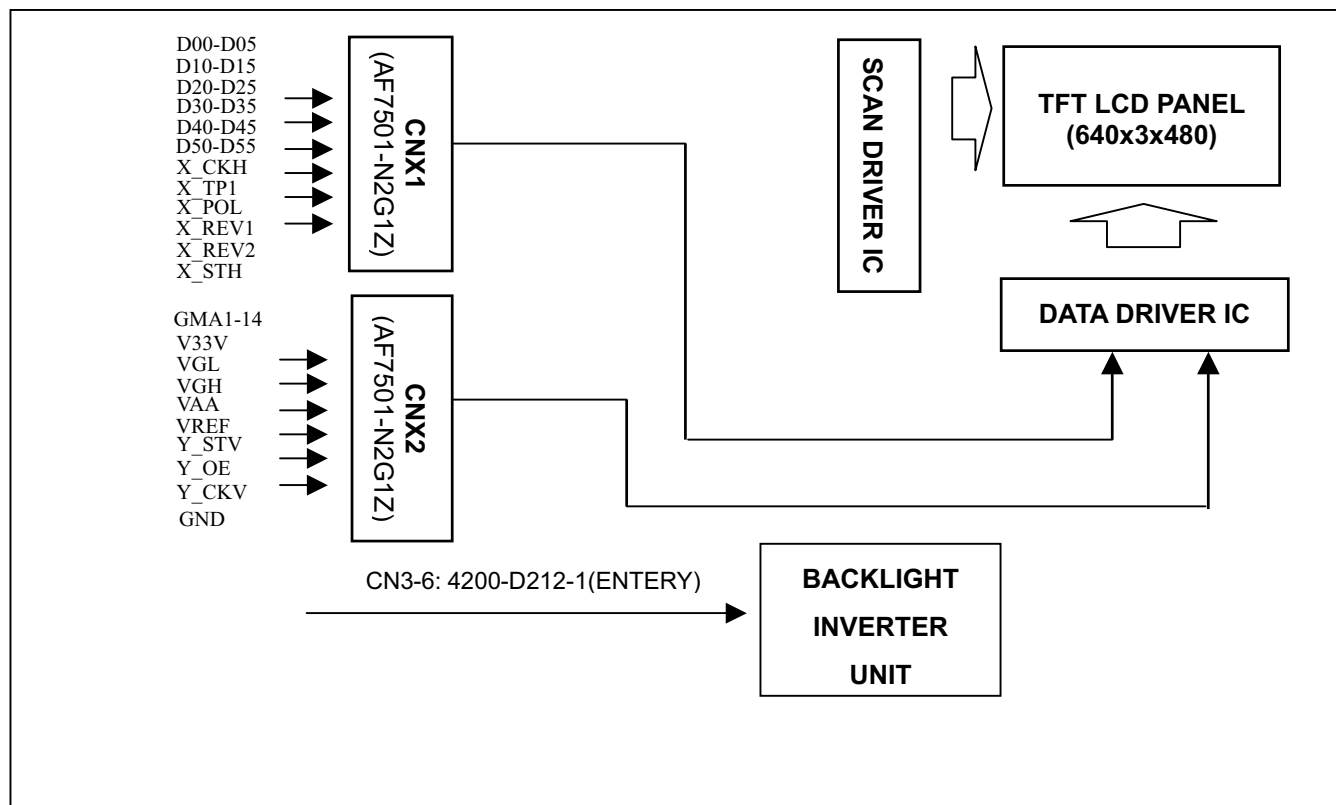
Model No.: V201V4-T01

**Approval**

Note (4) The life time of a lamp is defined as when the brightness is larger than 50% of its original value and the effective discharge length is longer than 80% of its original length (Effective discharge length is defined as an area that has equal to or more than 70% brightness compared to the brightness at the center point.) as the time in which it continues to operate under the condition  $T_a = 25 \pm 2^\circ\text{C}$  and  $I_L = 5.0 \sim 6.0 \text{ mA}_{\text{RMS}}$ .

## 4. BLOCK DIAGRAM

### 4.1 TFT LCD MODULE





## 5. INTERFACE PIN CONNECTION

### 5.1 TFT LCD MODULE

#### CNX1 Connector Pin Assignment

Pin No.	Name	Description	Pin No.	Name	Description
1	VSS	Ground	26	X_POL	polarity invert
2	X_D00	Even R	27	X_TP1	Latch
3	X_D01		28	X_CKH	Data driver clock
4	X_D02		29	VSS	Ground
5	X_D03		30	NC	No Connection
6	X_D04		31	X_D30	Odd R
7	X_D05		32	X_D31	
8	VSS	Ground	33	X_D32	
9	X_D10	Even G	34	X_D33	
10	X_D11		35	X_D34	
11	X_D12		36	X_D35	
12	X_D13		37	VSS	Ground
13	X_D14		38	X_D40	Odd G
14	X_D15		39	X_D41	
15	VSS	Ground	40	X_D42	
16	X_D20	Even B	41	X_D43	
17	X_D21		42	X_D44	
18	X_D22		43	X_D45	
19	X_D23		44	VSS	Ground
20	X_D24		45	X_D50	Odd B
21	X_D25		46	X_D51	
22	VSS	Ground	47	X_D52	
23	X_STHI	Data driver start pulse	48	X_D53	
24	X_REV1	Data reversion 1	49	X_D54	
25	X_REV2	Data reversion 2	50	X_D55	

**CNX2 Connector Pin Assignment**

Pin No.	Name	Description	Pin No.	Name	Description
1	GND	Ground	26	GND	Ground
2	V33V	Logic Power supply	27	NC	No Connection
3	V33V		28	NC	No Connection
4	GND	Ground	29	VGH	Driver Power supply
5	GND	Ground	30	VGH	
6	VREF	Gamma Power supply	31	GND	Ground
7	VAA	Driver Power supply	32	VGL	Driver Power supply
8	VAA		33	VGL	
9	VAA		34	GND	Ground
10	GND	Ground	35	GND	Ground
11	GMA1	Gamma Voltage	36	NC	No Connection
12	GMA2		37	NC	No Connection
13	GMA3		38	NC	No Connection
14	GMA4		39	V33V	Logic Power supply
15	GMA5		40	V33V	
16	GMA6		41	V33V	
17	GMA7		42	V33V	
18	GND	Ground	43	GND	Ground
19	GMA8	Gamma Voltage	44	GND	Ground
20	GMA9		45	GND	Ground
21	GMA10		46	NC	No Connection
22	GMA11		47	NC	No Connection
23	GMA12		48	Y_CKV	Scan driver clock
24	GMA13		49	Y_OE	Scan driver output enable
25	GMA14		50	Y_STV	Scan driver start pulse

Note (1) CNX1 、 2 Connector Part No.: AF7501-N2G1Z or compatible

## 5.2 BACKLIGHT UNIT

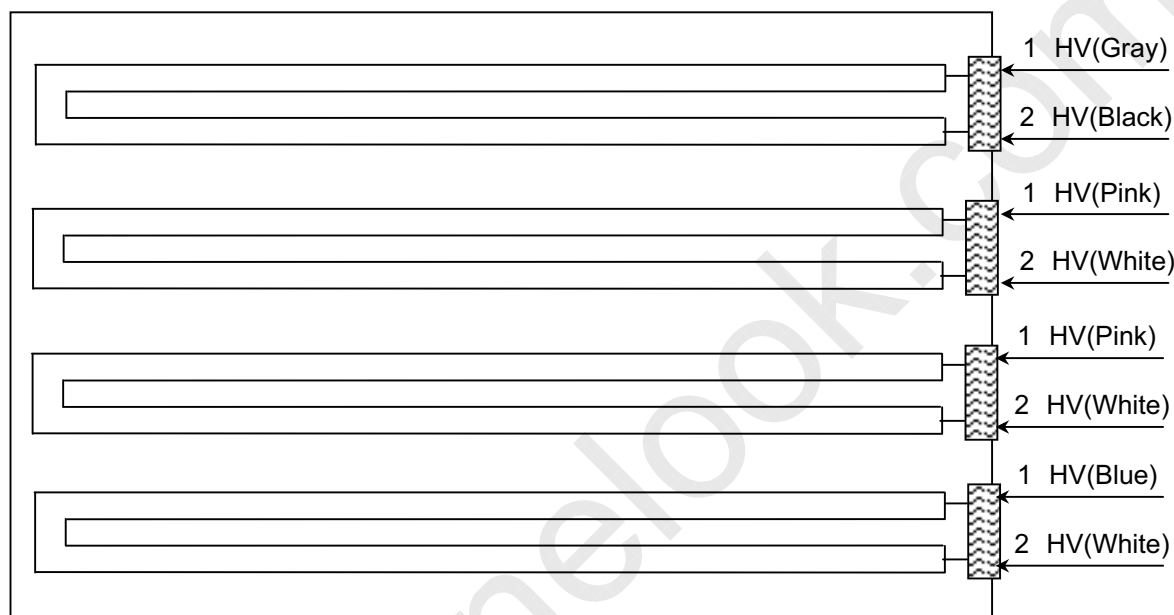
The pin configuration for the housing and leader wire is shown in the table below.

CN3-CN6(Housing): BHR-04VS-1

Pin No	Signal name	Feature	Wire Color
1	HV	High Voltage	Gray / Pink / Blue
2	HV	High Voltage	Black / White / White

Note (1) The backlight interface housing for high voltage side is a model BHR-04VS-1, manufactured by JST.

The mating header on inverter part number is SM02(12.0)B-BHS-1-TB.



### 5.3 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																														
		Red								Green								Blue														
R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0									
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Red(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Red(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
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	Red(253)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
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	Green(253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Blue	Blue(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	
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	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	0	
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	

Note (1) 0: Low Level Voltage, 1: High Level Voltage

## 6. INTERFACE TIMING

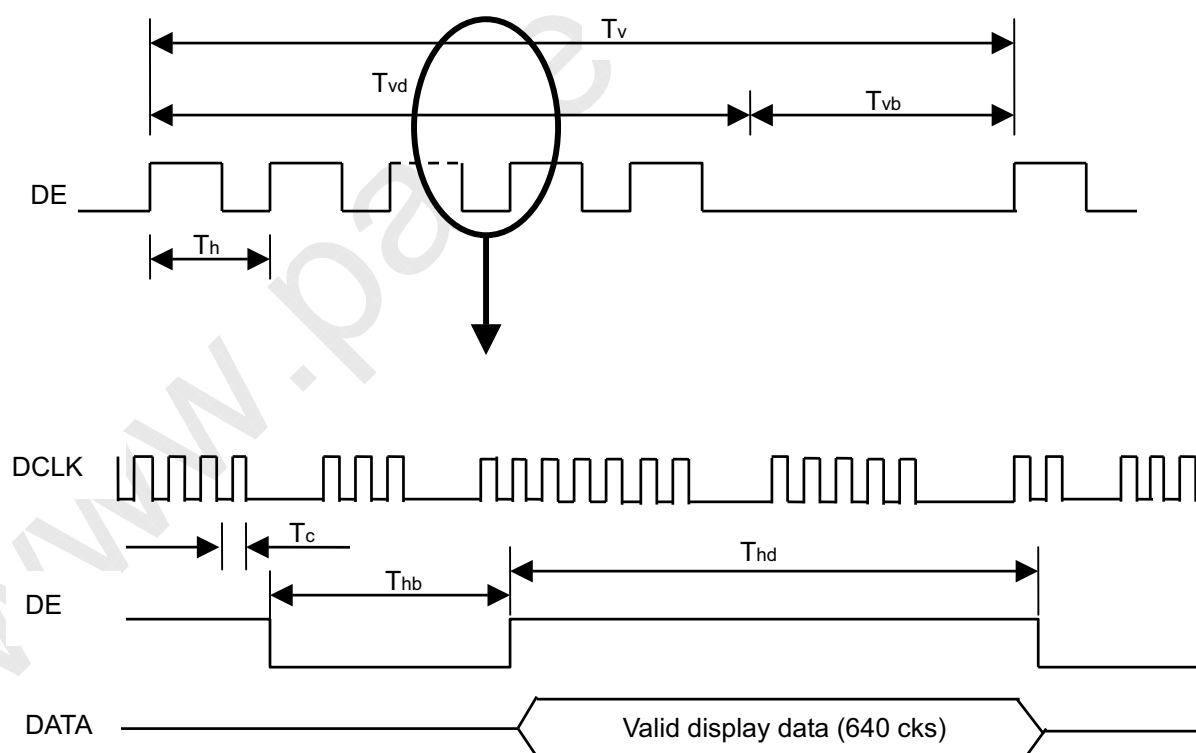
### 6.1 INPUT SIGNAL TIMING SPECIFICATIONS

The input signal timing specifications are shown as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
Clock	Frequency	1/Tc	20	25	30	MHz	
Vertical Active Display Term	Frame Rate	Fr	50	60	70	Hz	
	Total	Tv	500	525	550	Th	Tv=Tvd+Tvb
	Display	Tvd	480	480	480	Th	
	Blank	Tvb	20	45	70	Th	
Horizontal Active Display Term	Total	Th	700	800	900	Tc	Th=Thd+Thb
	Display	Thd	640	640	640	Tc	
	Blank	Thb	60	160	260	Tc	

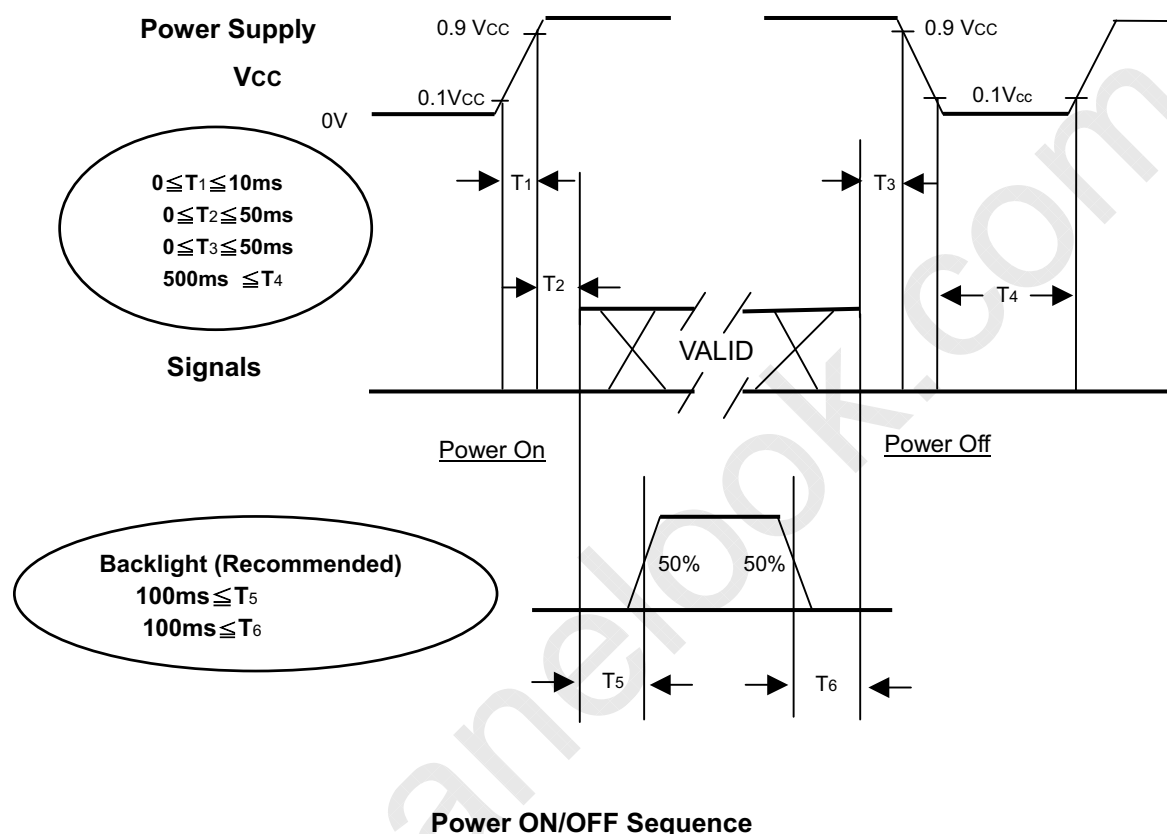
Note (1) Since this module is operated in DE only mode, Hsync and Vsync input signals should be set to low logic level. Otherwise, this module would operate abnormally.

### INPUT SIGNAL TIMING DIAGRAM



## 6.2 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should be as the diagram below.



Note (1) The supply voltage of the external system for the module input should follow the definition of Vcc.

Note (2) Apply the lamp voltage within the LCD operation range. When the backlight turns on before the LCD operation or the LCD turns off before the backlight turns off, the display may momentarily become abnormal screen.

Note (3) In case of Vcc is in off level, please keep the level of input signals on the low or high impedance.

Note (4) T4 should be measured after the module has been fully discharged between power off and on period.

Note (5) Interface signal shall not be kept at high impedance when the power is on.

## 7. OPTICAL CHARACTERISTICS

### 7.1 TEST CONDITIONS

Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Lamp Current	I <sub>L</sub>	5.5±0.5	mA
Oscillating Frequency (Inverter)	F <sub>W</sub>	56±3	KHz

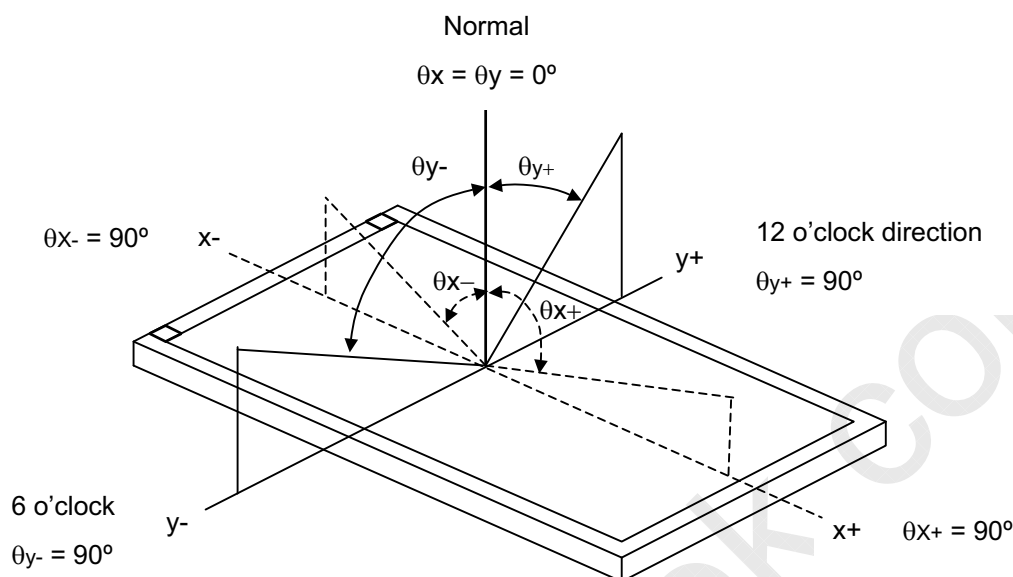
### 7.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 7.2. The following items should be measured under the test conditions described in 7.1 and stable environment shown in Note (6).

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note	
Contrast Ratio		CR	$\theta_x=0^\circ, \theta_Y=0^\circ$ Viewing Normal Angle	300	400	-	-	Note(2)	
Response Time		T <sub>R</sub>		-	5	-	ms	Note(3)	
		T <sub>F</sub>		-	11	-	ms		
Center Luminance of White		L <sub>C</sub>		400	450	-	cd/m <sup>2</sup>	Note(4)	
White Variation		δW		-	-	1.6	-	Note(7)	
Cross Talk		CT		-	-	4	%	Note(5))	
Color Chromaticity	Red	R <sub>x</sub>		0.617	0.647	0.677	-	Note(6)	
		R <sub>y</sub>		0.300	0.330	0.360	-		
	Green	G <sub>x</sub>		0.243	0.273	0.303	-		
		G <sub>y</sub>		0.571	0.601	0.631	-		
	Blue	B <sub>x</sub>		0.113	0.143	0.173	-		
		B <sub>y</sub>		0.036	0.066	0.096	-		
	White	W <sub>x</sub>		0.255	0.285	0.315	-		
		W <sub>y</sub>		0.263	0.293	0.323	-		
	Color Gamut				70	75	-	%	NTSC
	Viewing Angle	Horizontal		θ <sub>x</sub> +	70	80	-	Deg.	Note(1)
θ <sub>x</sub> -				70	80	-			
Vertical		θ <sub>y</sub> +		60	70	-			
		θ <sub>y</sub> -		60	70	-			

Note (1) Definition of Viewing Angle ( $\theta_x$ ,  $\theta_y$ ):

Viewing angles are measured by Eldim EZ-Contrast 160R



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{255} / L_0$$

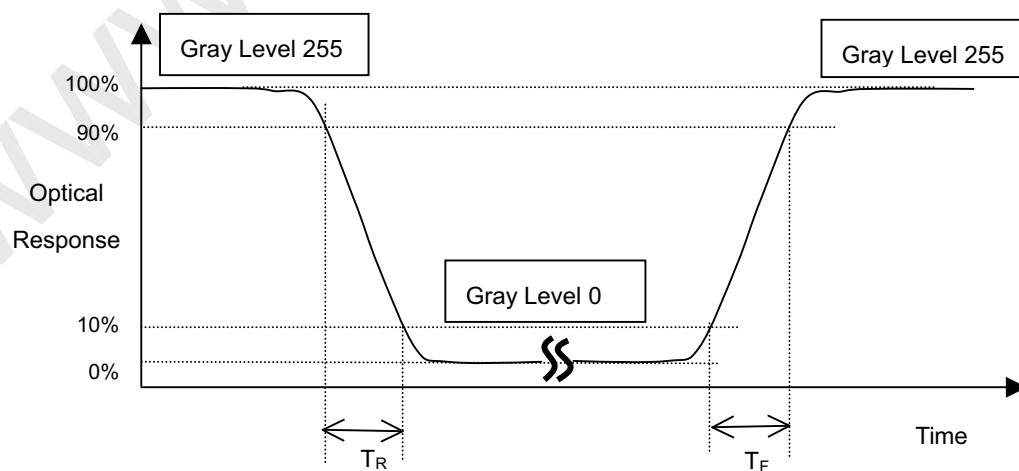
L255: Luminance of gray level 255

L 0: Luminance of gray level 0

$$\text{CR} = \text{CR} (5)$$

CR (X) is corresponding to the Contrast Ratio of the point X at the figure in Note (7).

Note (3) Definition of Response Time ( $T_R$ ,  $T_F$ ):



Note (4) Definition of Luminance of White ( $L_C$ ,  $L_{AVE}$ ):

Measure the luminance of gray level 255 at center point and 5 points

$$L_C = L(5)$$

$$L_{AVE} = [L(1) + L(2) + L(3) + L(4) + L(5)] / 5$$

$L(x)$  is corresponding to the luminance of the point X at the figure in Note (7).

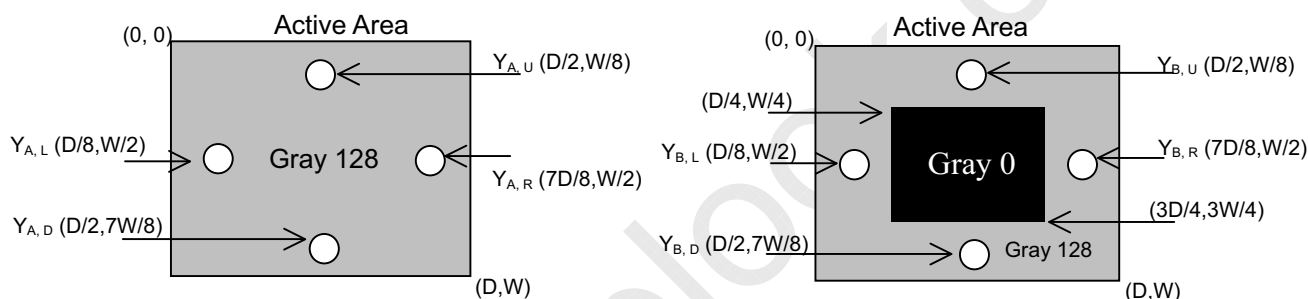
Note (5) Definition of Cross Talk (CT):

$$CT = |Y_B - Y_A| / Y_A \times 100 (\%)$$

Where:

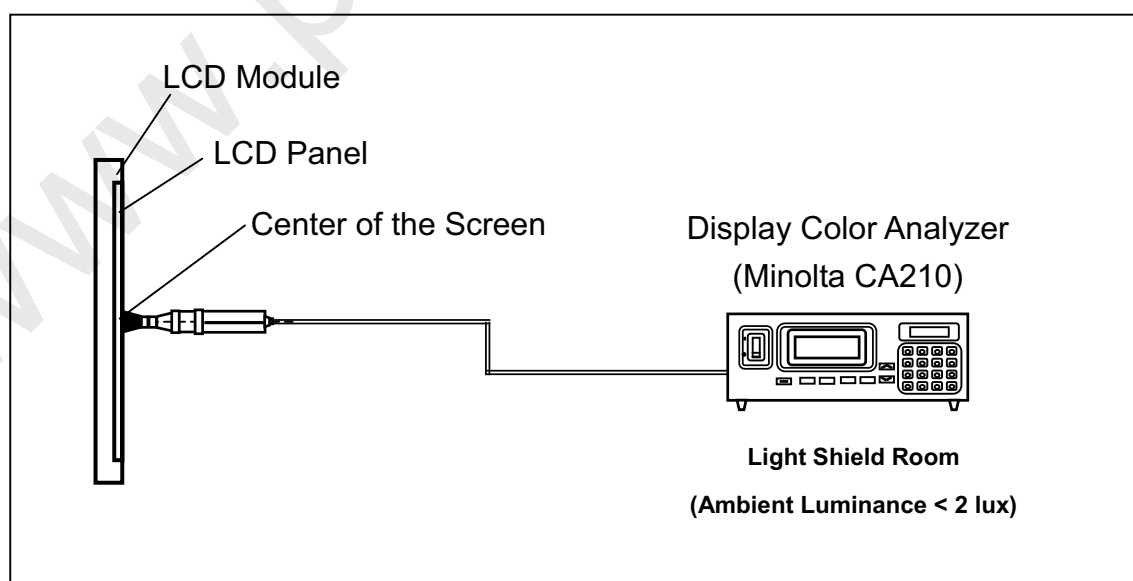
$Y_A$  = Luminance of measured location without gray level 0 pattern ( $\text{cd/m}^2$ )

$Y_B$  = Luminance of measured location with gray level 0 pattern ( $\text{cd/m}^2$ )



Note (6) Measurement Setup:

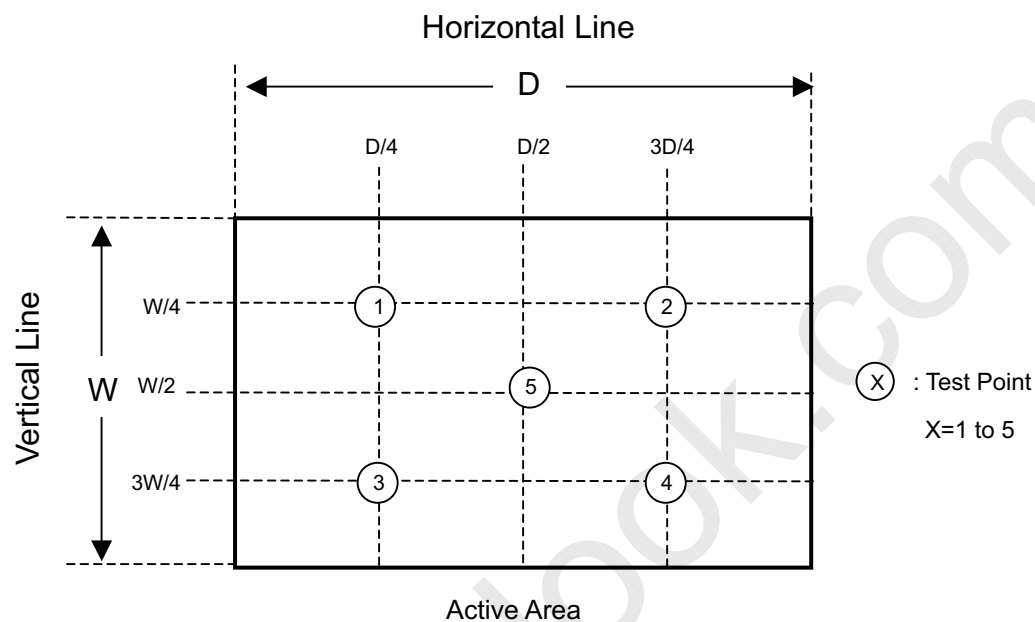
The LCD module should be stabilized at given temperature for 1 hour to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 1 hour in a windless room.



Note (7) Definition of White Variation ( $\delta W$ ):

Measure the luminance of gray level 255 at 5 points

$$\delta W = \text{Maximum [L (1), L (2), L (3), L (4), L (5)] / Minimum [L (1), L (2), L (3), L (4), L (5)]}$$



## 8. PRECAUTIONS

### 8.1 ASSEMBLY AND HANDLING PRECAUTIONS

- (1) Do not apply rough force such as bending or twisting to the module during assembly.
- (2) It is recommended to assemble or to install a module into the user's system in clean working areas.  
The dust and oil may cause electrical short or worsen the polarizer.
- (3) Do not apply pressure or impulse to the module to prevent the damage of LCD panel and Backlight.
- (4) Always follow the correct power-on sequence when the LCD module is turned on. This can prevent the damage and latch-up of the CMOS LSI chips.
- (5) Do not plug in or pull out the I/F connector while the module is in operation.
- (6) Do not disassemble the module.
- (7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
- (8) Moisture can easily penetrate into LCD module and may cause the damage during operation.
- (9) High temperature or humidity may deteriorate the performance of LCD module. Please store LCD modules in the specified storage conditions.
- (10) When ambient temperature is lower than 10°C, the display quality might be reduced. For example, the response time will become slow, and the starting voltage of CCFL will be higher than that of room temperature.

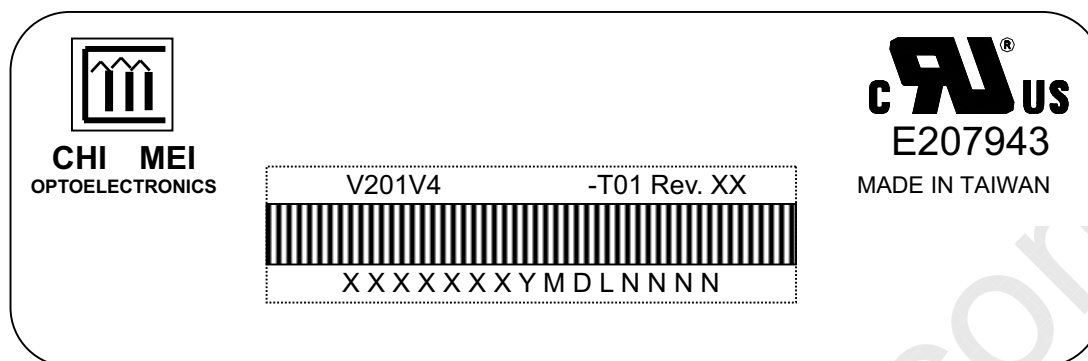
### 8.2 SAFETY PRECAUTIONS

- (1) The startup voltage of a Backlight is approximately 1000 Volts. It may cause an electrical shock while assembling with the inverter. Do not disassemble the module or insert anything into the Backlight unit.
- (2) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- (3) After the module's end of life, it is not harmful in case of normal operation and storage.

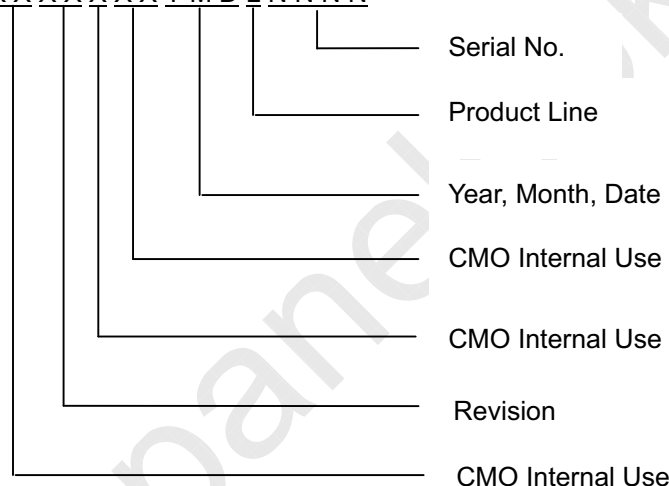
## 9. DEFINITION OF LABELS

### 9.1 CMO MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



- (a) Model Name: V201V4-T01  
 (b) Revision: Rev. XX, for example: A0, A1... B1, B2... or C1, C2...etc.  
 (c) Serial ID: X X X X X X X Y M D L N N N N



Serial ID includes the information as below:

- (a) Manufactured Date: Year: 0~9, for 2000~2009  
 Month: 1~9, A~C, for Jan. ~ Dec.  
 Day: 1~9, A~Y, for 1<sup>st</sup> to 31<sup>st</sup>, exclude I, O, and U.  
 (b) Revision Code: Cover all the change  
 (c) Serial No.: Manufacturing sequence of product  
 (d) Product Line: 1 -> Line1, 2 -> Line 2, ...etc.

## 10. PACKAGING

### 10.1 PACKING SPECIFICATIONS

- (1) 6 LCD TV modules / 1 Box
- (2) Box dimensions : 582(L) X 493 (W) X 440 (H)
- (3) Weight : approximately 17.5Kg ( 6 modules per box)

### 10.2 PACKING METHOD

Figures10-1 and 10-2 are the packing method

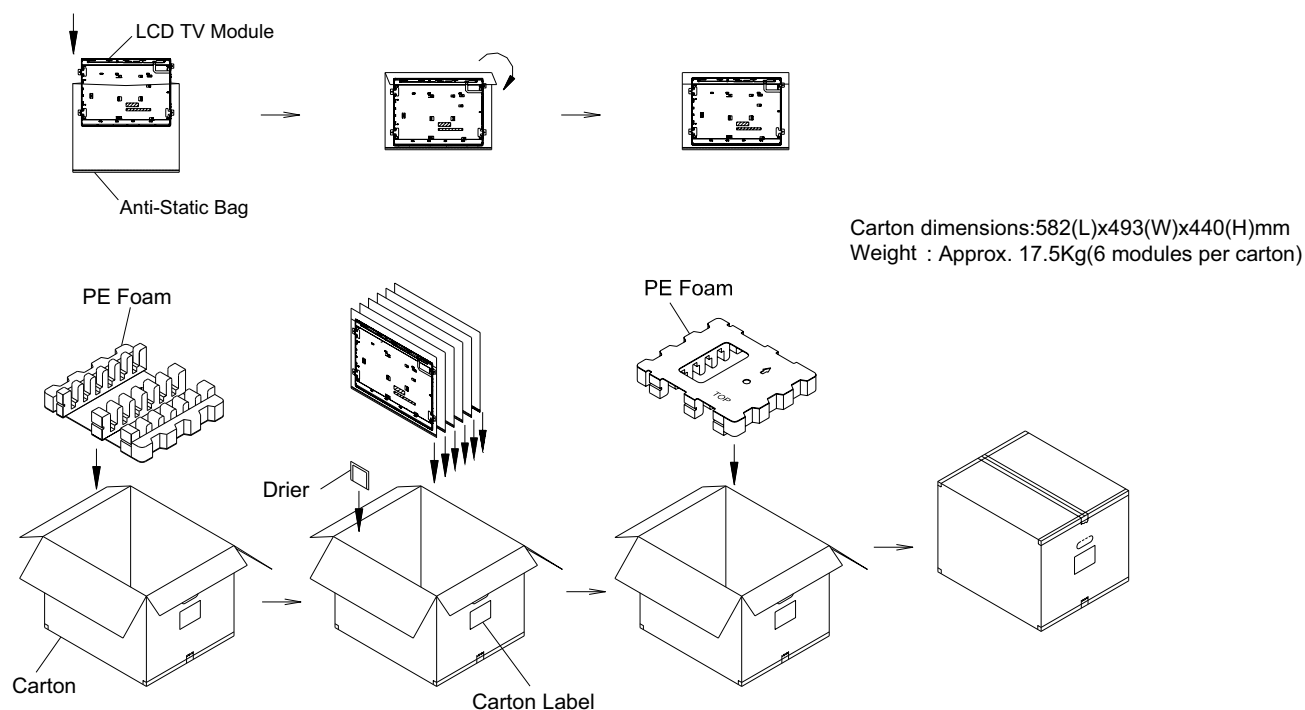


Figure.10-1 packing method

Corner Protector:L1250\*50mm\*50mm

Pallet:L1000\*W1180\*H143mm

Corrugated Fiberboard:L1000\*W1180mm

Pallet Stack:L1000\*W1180\*H1463mm

Gross:227kg

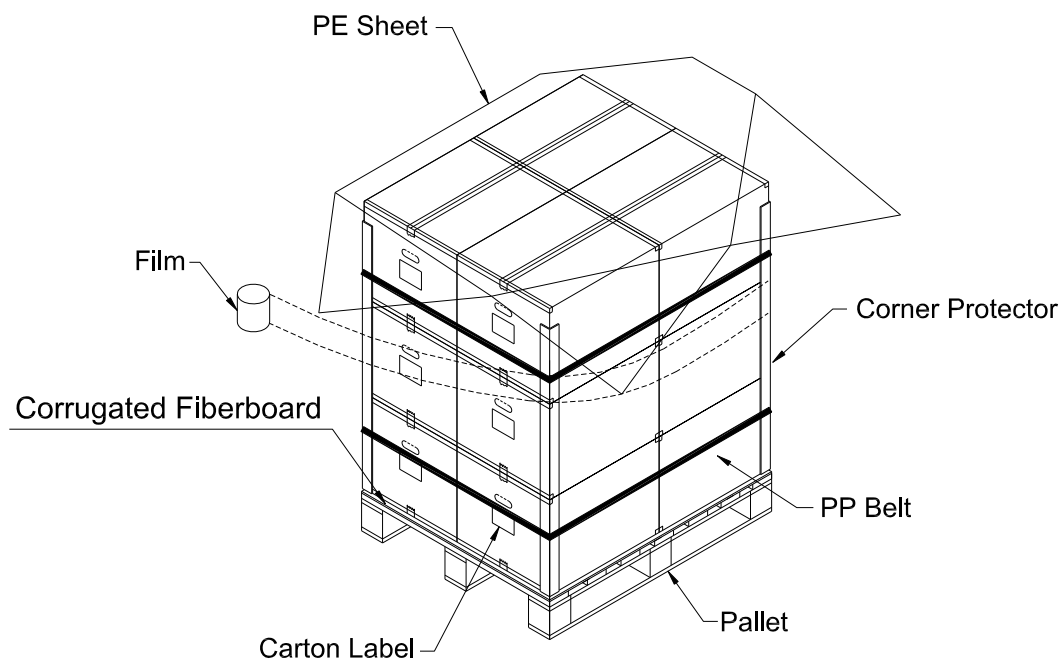


Figure.10-2 packing method

## 11. MECHANICAL CHARACTERISTIC

